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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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McDermott Will & Emery
600 13th Street NW
Washington, DC 20005-3096

EXAMINER	
LOKE, STEVEN HO YIN	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/661,035	TERASHIMA, TOMOHIDE	
	Examiner	Art Unit	
	Steven Loke	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondenc address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 March 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *7,8 and 13* is/are allowed.

6)☒ Claim(s) *1-6 and 9-11* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

1. Claims 4 and 9 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification never discloses the advantage to have the fourth region electrically connected to the first electrode portion as claimed in claim 4.

The specification never discloses the advantage to have the fourth region electrically connected to the second electrode portion as claimed in claim 9.

2. Claims 2, 5, 6, 10 and 11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Fig. 30 discloses a fifth region (collector region [19]) of the first conductivity type surrounding the third electrode portion (collector electrode [13]). Fig. 30 also discloses the first region (base region [2]) is spaced apart from the third electrode portion. Then, it is unclear how a third electrode portion connected to a first region of a second conductivity type (claim 1) while a fifth region of the first conductivity surrounding the third electrode portion, and formed at and near the surface of the first region as claimed in claim 2.

Since claim 1 discloses a single fourth region of the first conductivity type having an interface with the first region such that a position of the interface between the first region and the fourth region in a depth direction changes for any cross sections crossing a

region in which the interface exists along a direction of flow of the current, and the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow, claim 1 can only read on the embodiment of the invention in figs. 14 and 15. Since there is no fourth region formed between the discretely formed neighboring regions of the fourth region, it is unclear how the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow for a fourth region comprises a plurality of discretely formed neighboring regions as claimed in claim 5.

Claim 7 discloses a single fourth region of the first conductivity type having a depth changing as a position moves in a direction crossing of flow of the current. However, it is unclear how a plurality of discretely formed regions are able to have a depth changing as a position moves in a direction crossing a direction of flow of the current as claimed in claim 10.

3. Claim 10 is objected to because of the following informalities: Claim 10, line 4, the second occurrence of the word "connection" should be deleted . Appropriate correction is required.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitamura et al.

In regards to claim 1, Kitamura et al. disclose a semiconductor device in figs. 6(a) and 6(b). It comprises: a semiconductor substrate [1] of a first conductivity type; a first region [2] of a second conductivity type formed on and in direct contact with the semiconductor substrate; a second region [8] of the second conductivity type formed at and near the surface of the first region; a third region [3] of the first conductivity type formed at and near the surface of the first region, and surrounding the second region; a first electrode portion [7] formed on the surface of the third region located between the first and second regions with an insulating film [6] therebetween; a second electrode portion [12a] connected to the second region; a third electrode portion [13] connected to the first region and spaced by a distance from the third region; and a fourth region [4] of the first conductivity type formed at and near the surface of the first region between the third electrode portion and the third region; wherein, a position of the interface between the first region and the fourth region in a depth direction changes for any cross sections crossing a region in which the interface exists along a direction of flow of the current (the curved interface portion between region [4] and region [2] near region [9] in fig. 6(b)).

Kitamura et al. differ from the claimed invention by not showing the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow.

Since Kitamura et al. disclose the high withstand voltage MOSFET is formed by the DMOS process, it would have been obvious for the fourth region is formed by the impurity diffusion method because it is a widely used method to form a semiconductor region in a semiconductor device.

Since the p-type region [4] can be an impurity diffusion region, the pn junction formed between the p-type region [4] and the n-type region [2] would be a curved junction in a direction crossing a direction of flow of the current. Therefore, the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow.

In regards to claim 3, it is inherent that the fourth region [4] is fixed to a constant potential because the source electrode [12a] is always connected to a constant source potential.

In regards to claim 4, Kitamura et al. further disclose the fourth region [4] is electrically connected to the second electrode portion [12a].

6. Applicant's arguments filed 3/10/03 have been fully considered but they are not persuasive.

It is urged, in page 6 of the remarks, that the specification teaches fixing the fourth region [7] to a constant potential (second electrode portion [9]) in the fourth embodiment (page 16, line 28 to page 17, line 22). However, the specification never discloses the advantage to have the fourth region [7] electrically connected to the first electrode portion (gate electrode [8a] of fig. 22) as claimed in claim 4. The specification also

never discloses the advantage to have the fourth region (region [7]) electrically connected to the second electrode portion (emitter electrode [11]) as claimed in claim 9.

It is urged, in page 7 of the remarks, that the ninth embodiment of the invention (page 22, lines 27-33 and fig. 30) teach the fifth region of the first conductivity type surrounding the third electrode portion and formed at and near the surface of the first region. However, claim 1 requires a third electrode portion connected to the first region [2] while claim 2 requires the third electrode portion connected to the fifth region [19]. Claim 2 is inconsistent with claim 1.

It is urged, in page 7 of the remarks, that the specification (page 10, lines 1-12) explains how a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of current. However, claim 1 is directed to a single fourth region having a position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow. It is believed that only a continuous region (for example, fig. 15 of the present application) shows the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow. The plurality of discretely formed regions of claims 5 and 10 cannot show the position of the interface in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow.

It is urged, in pages 8-9 of the remarks, that Kitamura semiconductor device includes a portion in which a position of an interface between region [4] (the fourth region) and

region [2] (the first region) in depth direction is constant and does not change for a direction crossing a direction of the current flow on upstream and downstream sides of the current flow for opening 36, as shown on attached sheet A (see the cross section Y'-Y'). Since the p-type region [4] can be an impurity diffusion region, the pn junction formed between the p-type region [4] and the n-type region [2] would be a curved junction in a direction crossing a direction of flow of the current. Then, the p-type region [4] along the cross-section X-X of the attached sheet A of the remarks should have a curved pn junction. Therefore, the position of the interface between region [4] and region [2] in the depth direction also changes for any cross sections crossing the region along a direction substantially orthogonal to the direction of the current flow. The applicant cannot rely the cross-section Y'-Y' of the attached sheet A of the remarks to interpret the claimed limitation.

7. Claim 2 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

8. Claim 12 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claims 7, 8 and 13 are allowed.

10. The following is a statement of reasons for the indication of allowable subject matter: The first major difference in the claims not found in the prior art of record is a semiconductor device comprising a fifth region of the first conductivity type surrounding

the third electrode portion and formed at and near the surface of the first region. The second major difference in the claim not found in the prior art of record is a semiconductor device comprising a fourth region having a continuous region having changing depths in a direction crossing a direction of current flow. The third major difference in the claims not found in the prior art of record is semiconductor device having a second electrode portion connected to a second region and a fourth region having a depth changing as a position moves in a direction crossing a direction of flow of the current.

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven Loke whose telephone number is (703) 308-4920. The examiner can normally be reached on 7:50 am to 5:20 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

sl
May 28, 2003

Steven Loke
Primary Examiner

Steven Loke